

ERASMUS program in higher education: impact analysis on supporting innovation and entrepreneurship Case of: European Union

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Abstract: Through our research we tried to highlight the role of Erasmus program in higher education at driving innovation and entrepreneurship in the EU countries. through measuring its impact on the trademark. In order to reach our objective, we used the bound cointegration technique (Autoregressive Distributed Lag (ARDL) cointegration technique) to estimate the long run relationship and to analyze the implication of student mobility and Erasmus program annual budget on the higher education entrepreneurship spirit of the graduated students in the European Union during the period 1996-2017. As a result, we figured out a significant positive long run relationship between annual Erasmus spending budget, the number of student mobility and the trademark creation, where an increase in the number of student mobility by 1% leads to an increase in the creation of trade mark by 0,32%, and an increase in Erasmus budget by 1% give rise to trademark creation by 0,38% in the long run . Finally, we conclude from the research results that the goal of supporting business and entrepreneurship which was measuring by the trademark is confirmed from 1996 to 2017 and would be achieved in the long term under these variables.

Key words: Erasmus, European Union, higher education, entrepreneurship, innovation.

من خلال بحثنا سنحاول تسليط الضوء على نجاح برنامج الايراسموس في الملخص:
تشجيع الابتكار وريادة الأعمال في الاتحاد الأوروبي من خلال قياس تأثيره على تطور إنشاء
العلامات التجارية المسجلة والمشاريع.

من أجل تحقيق هدف بحثنا اعتمدنا في دراستنا التطبيقية على نموذج الانحدار
الذاتي للإبطاء الزمني الموزع لتقدير العلاقة طويلة الأجل وتحليل الآثار المترتبة على تنقل
الطلاب في إطار برنامج الايراسموس والميزانية السنوية المخصصة لذلك على روح المقاولاتية
وريادة الأعمال في الاتحاد الأوروبي خلال الفترة 1996-2017 وتوصلنا من خلال تحليل نتائج
النموذج إلى وجود علاقة إيجابية طويلة المدى بين تطور عدد الطلاب المستفيدين وميزانية
الإنفاق السنوية التي يخصصها برنامج الايراسموس لتنقل الطلاب وتسجيل العلامات

التجارية الذي اعتمدناه كمؤشر للمقاولاتية والابتكار، حيث تؤدي الزيادة في عدد الطلاب المتنقلين في إطار البرنامج بنسبة 1٪ إلى زيادة في تسجيل العلامات التجارية بنسبة 0.32٪ ، وزيادة في ميزانية البرنامج بنسبة 1٪ تؤدي إلى زيادة إنشاء علامات تجارية بنسبة 0.38٪ على المدى الطويل.

أخيرا، يمكننا القول أن هذه النتائج تؤكد أن الهدف الرئيسي للبرنامج قد تحققه من عام 1996 إلى عام 2017 وسيتم تحقيقه على المدى الطويل في ظل هذه المتغيرات. الكلمات المفتاحية: إيراسموس، اتحاد أوروبي، تعليم عالي، مقاولاتية، ابتكار

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1. Introduction:

in bold type, Times New Roman, font size The European Union's Erasmus program is a funding scheme to support activities in the fields of Education, Training, Youth and Sport but in our research paper we focused only on higher education projects.

Cooperation projects under Erasmus allow students and higher education staff to develop their innovation and business skills. Over one in four projects under Erasmus+ contribute to strengthening entrepreneurial education, entrepreneurship and invention with nearly a third of these projects resulting in start-ups and spin-off enterprises.

Every year, more than 300.000 students study or train under the Erasmus umbrella and over five million students have directly benefitted since the launch of the program in 1987.

By encouraging the higher education institutions to cooperate with each other, Erasmus Exchange Program aims at improving the quality of higher education, increasing the employability and encouraging innovation and entrepreneurship. Our main discussion in this paper would be the influence of the program through the students' mobility program EU the entrepreneurial spirit and innovation.

According to the above, the basic problem of this research can be posed by the following question:

How does Erasmus program in higher education affect the entrepreneurship in the European Union?

The hypotheses suggested to answer the question are the following:

-The cooperation between the higher education institutions under the Erasmus exchange program has a positive impact on the level of innovation and entrepreneurship in the EU.

-Student mobility exchange encourages the acquisition of the entrepreneurial spirit.

In order to achieve our study and verify the hypotheses we applied an econometric study using ARDL model where the entrepreneurship is the dependent variable represented by the trademark as a proxy and the student mobility, the budget of the Erasmus program as independent variables that represent the Erasmus cooperation program.

2. Theoretical part:

2.1. About erasmus mendus programm:

What is the Erasmus program?

Erasmus+ is the EU's program to support education, training, youth and sport in Europe. Its budget of €14.7 billion will provide opportunities for over 4 million Europeans to study, train, and gain experience abroad.

Set to last until 2020, Erasmus+ doesn't just have opportunities for students. Merging seven prior programs, it has opportunities for a wide variety of individuals and organizations.

For nearly 30 years, the EU has funded the Erasmus program, which has enabled over three million European students to spend part of their studies at another higher education institution or with an organization in Europe.

Erasmus+ brings such opportunities to all - students, staff, trainees, teachers, volunteers and more. It's not just about Europe or Europeans either - with Erasmus+, people from all over the world can access opportunities.

Studying abroad is a central part of Erasmus+ and has been shown to have a positive effect on later job prospects. It is also an opportunity to improve language skills, gain self-confidence and independence and immerse yourself in a new culture.

Opportunities are available for students at Bachelor, Master or Doctoral levels. (about erasmus plus, 2020)

Participating Program Countries:

Erasmus+ is the EU's flagship program to support and strengthen education, training, youth and sport in Europe with 33 participating Program Countries: all 28 EU Member States plus Turkey, the former Yugoslav Republic of Macedonia, Norway, Iceland and Liechtenstein (zuhal, 2015).

Erasmus Mundus cooperation in higher education:

The Erasmus program has become the most significant program for European cooperation in Higher Education (and the promotion of mobility). It promises to play an ever-greater role in the future, thus continuing its trend of growth and liberalization. Due to this upward trend, some had anticipated its record-breaking figure of 3 million students during the period 2012–2013. This fact has been confirmed recently by the European Commission (2014) in a report about the global impact of the program. Moreover, the economic crisis is reinforcing European interest in education. Education, particularly higher education, is seen as being one of the most important areas of cooperation in seeking a way out of the economic, this trend reinforces the role of the Erasmus program and boosts its aforementioned growth. (María-Jesús, Pausá, & García-López, 2017)

Erasmus mundus action's in higher education:

Erasmus Mundus is a cooperation and mobility program in the field of higher education, providing support to universities and individual students, researchers and university staff. It does this through three Actions:

Action1: "Learning Mobility for individuals": Student credit mobility and staff mobility (within Program Countries and / or to / from Partner Countries. Erasmus Mundus Joint Programs (Masters courses and Joint Doctorates).

Action 2: "Cooperation for innovation and good practices": Strategic Partnerships, Knowledge Alliances, and capacity Building Partnerships with Partner Countries.

Action 3: "Support for policy reform": networks and policy support measures, Erasmus Mundus Attractiveness Projects, this Action of the Program funds projects to enhance the attractiveness, profile, image and visibility of European higher education worldwide.

Action 3 provides support to activities related to the international dimension of all aspects of higher education, such as promotion, accessibility, quality assurance, credit recognition, mutual recognition of qualifications, curriculum development and mobility. (National Tempus Office (NTO) Georgia, 2014)

Objectives:

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By encouraging the higher education institutions to cooperate with each other, Erasmus Exchange Program aims at:

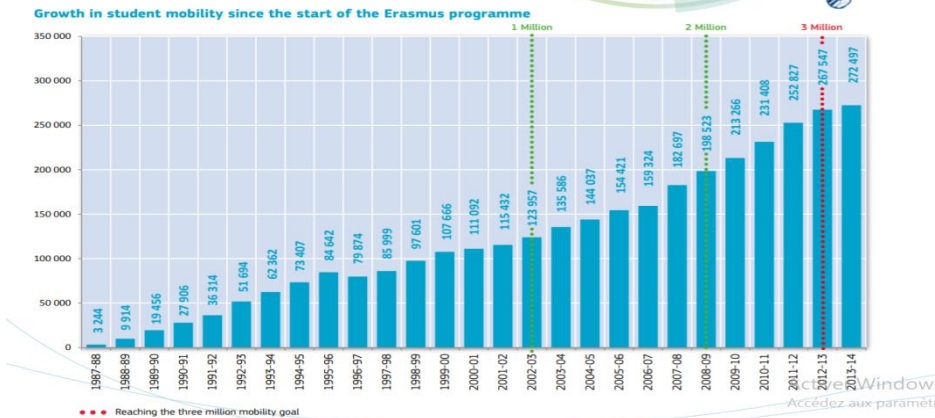
- allowing students to study abroad and to recognize European countries and cultures,
- contributing to the strengthening of communication and cooperation between countries; developing and popularizing of European standards in education;
- Improving the quality of higher education.
- Raising the equipped individuals who will fulfill the expectations of business world and the universities which provide qualified higher education services (zuhal, 2015)
- Providing the outgoing students with new abilities and different experiences.
- enhancing the employment opportunities of the outgoing students (zuhal, 2015)

Erasmus and Mobility of students:

Erasmus Program gets into the act in two different areas including Staff Mobility and Student Mobility. Apart from the staff mobility, there are two types of Erasmus mobility program for students. Within the framework of the Student Mobility Program students can benefit from student mobility for studies and student mobility for traineeship.

- Erasmus Student Mobility for Studies can be carried out within the bilateral agreements between institutions. By Erasmus Student Mobility For studies , students, who are registered to a higher education institution which has an Erasmus University Charter (EUC) and provides formal education in Turkey , will have the chance of being an exchange student for one or two semesters (between 3 and 12 months) in an academic year at a higher education institution in a European country.
- Student mobility for traineeships Learning Agreements for traineeships abroad follow similar procedures. However, greater care is required in drafting the Learning Agreement for traineeships as tasks to be performed in a particular workplace should be listed and corresponding learning outcomes, which are relevant to the final degree, should be agreed to. In addition, the plan for monitoring of traineeship activities should be arranged and specified, and carried out by the sending HEI and the mobility partner. (European commission, 2016).

Figure (1): growth in student mobility since the start of the Erasmus programme



Source: European commission, 2015

The figure (1) shows the growth in student mobility for all the countries and all the programs in higher education, we observe that the number is continuously growing since the start of the program.

Financial resources:

Within the Erasmus Exchange Program students will receive financial support for the period of education in which students stay abroad. Erasmus Program is a student exchange program carried out within the frame of the agreements between higher education institutions of European Union countries and the candidate countries. Program is supported by The European Union. (zuhail, 2015)

The potential impacts of the Erasmus Program:

In order to assess the impact of the Erasmus Program on innovation and higher education at the regional level, the potential impacts of the Erasmus Program are presented below (C. Santamarta & Mora-Guanche, 2015):

- Increase in the training of students and teachers, through the acquisition of knowledge from programs in other countries, as well as through improving skills for interaction internationally
- Improving the level of employability of participants in the program.
- Increasing the potential of research projects as result of cooperation between universities by establishing synergies

between various universities to facilitate more ambitious projects than if they were carried out individually.

- Promotion of the internationalization of universities, both through the interrelationship of the training offered to students and teachers as well as in university research.

2. 2. About intellectual property:

What is Intellectual Property?

Intellectual property refers to creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce (WIPO, 2020).

The categories of intellectual property

Intellectual property is divided into two categories (WIPO World Intellectual Property Organization):

Industrial Property: includes patents for inventions, trademarks, industrial designs and geographical indications.

- **Patent:** A patent is an exclusive right granted for an invention – a product or process that provides a new way of doing something, or that offers a new technical solution to a problem. A patent provides patent owners with protection for their inventions. Protection is granted for a limited period, generally 20 years.
- **Trademark:** A trademark is a distinctive sign that identifies certain goods or services produced or provided by an individual or a company. Its origin dates back to ancient times when craftsmen reproduced their signatures, or “marks”, on their artistic works or products of a functional or practical nature. Over the years, these marks have evolved into today’s system of trademark registration and protection. The system helps consumers to identify and purchase a product or service based on whether its specific characteristics and quality – as indicated by its unique trademark – meet their needs.
- **Industrial Design:** An industrial design refers to the ornamental or aesthetic aspects of an article. A design may consist of three-dimensional features, such as the shape or surface of an article, or two-dimensional features, such as patterns, lines or color. Industrial designs are applied to a wide variety of industrial products and handicrafts: from technical and medical instruments to watches, jewelry and other luxury items; from house wares and electrical appliances to vehicles and architectural structures; from textile designs to leisure goods.

Copyright: covers literary works (such as novels, poems and plays), films, music, artistic works and architectural design. Rights related to copyright include those of performing artists in their performances, producers of phonograms in their recordings, and broadcasters in their radio and television programs.

3. Empirical Study

3.1. Data and Variables :

The data used for investigating the impact of Erasmus program on innovation and entrepreneurship in the EU during the period 1990 to 2017 are taken from different sources.

Data symbols, description and sources are depicted in Table 1.

Table (1): data description

Variable	Symbol	Description	Resources
Trade Mark	TM	Total Trademark applications in the	World bank
Erasmus Budget	BG	annual Erasmus budget dedicated to student and staff	European commission
Student Mobility	SM	Growth in student mobility in the EU	Eurostat data base

3. 2. Time Series Study:

To check the stationarity of the series and to determine the order of integration I(d) of each one, we performed the ADF methodology with maximum lag number of 5 to avoid any serial correlation in the residual, (Wan Omar, Hussin, & Ali G H, 2015) and we adopted the Criterion of AIC and SC for the Lag length selection. The unit root test -ADF- results are shown in the Table 1.

Table (2): The ADF Test Results

Variables	Lag length (P)	order	Intercept	Tabulated value (%5)	Trend and intercept	Tabulated value (%5)	Processes	I(d)
			t-cal		t-cal			
LTM	P = 3	At-1st	-	-	-	-	DSP	I(0)
LSM	P = 4	At-1st	1.924	-	-	-	DSP	I(0)
LBG	P = 1	At-1st	-	-	-	-	DSP	I(1)

The source: Made by researchers using EViews 10.

For the unit root test, if the calculated value (t-cal) is smaller than the tabulated value at the level $\alpha = 5\%$; this indicates the absence of the unit root (the series is stationary at level I(0)). As we can observe from Table 1, we have mixture levels of integration for the underlying variables (I(0) and I(1)); the Trademark (TM) and the Student mobility (SM) series are stationary (I(0)), otherwise for the Erasmus annual Budget series (BG) is integration in the first order (I(1)). Therefore, it is important to note that the underlying variables are all integrated in order less than 2 (I(2)) which is essential for the application of the ARDL Model, (Nkoro & Uko, 2016) (A).

3. 3. Johansen and Juselius approach vs the ARDL approach:

To choose between the two methods we run the trace and max eigen test, if the trace or Maximal eigenvalue establishes that there is a single long-run relationship, ARDL approach can be applied rather than applying Johansen and Juselius approach. (Nkoro & Uko, 2016)

Table (3): Trace and Max Eigen Tests

Test	Trace / Max	Trace / Max Eigen	Critical Value (%5)	Prob***
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1* Difference Stationary Process

Trace / Max Eigen	0,554	15,355	3,841	0,0001***
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The source: Made by researchers using EViews 10.

From Table 2 we conclude that both Trace and Max Eigen tests indicate one cointegration equation at the level of 5% (**B**). Therefore, the application of the ARDL approach is more appropriate for our study.

3. 4. Application of the ARDL Cointegration Approach:

It seems from the previous results that the ARDL approach is more appropriate for our study, but we need to perform the Bounds test first, in order to emphasize whether a long-run relationship exists among the underlying variable or not, by computing the F-statistic using OLS method for testing the significance of the lagged levels of the variables in the error correction form. The performance of the bounds test proposed by Pesaran and al. (2001) is indicated in Table 3.

Table (4): The Bounds Testing

Test Statistic	Value	Signif.	I(0)	I(0)2*	I(1)	I(1)*
F- Statistic	7,081	10%	2,63	2.496	3,35	3.346
	K = 2	5%	3,10	2.962	3,87	3.910
		1%	4,13	4.068	5,00	5.250

The source: Made by researchers using EViews 10.

The value of F-statistical test (Wald test value = 7,081) is higher than the upper bounds whether it is assumed that all the variables are I(0) or all the variable are I(1) and even upper from all the bounds proposed by Narayan (2005). Consequently, we reject the null hypothesis (H0) that assumes the absence of a long-run relationship (cointegration

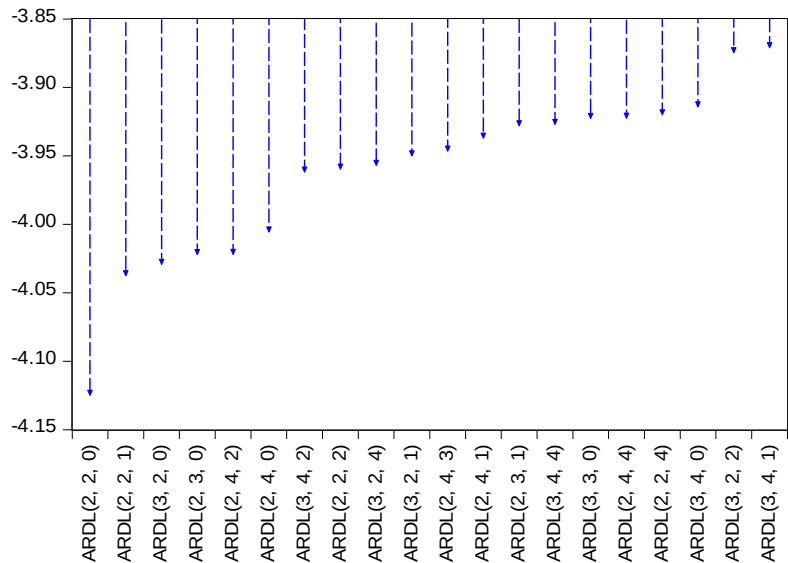
2* I(0)* and I(1)*, According to Narayan (2005), the existing critical values in Pesaran et al. (2001) cannot be applied for small sample sizes as they are based on large sample sizes that's why Narayan (2005) provides a set of critical values for small sample sizes, from 30 to 80 observations, which is our case (22 observations). The critical values are 2.496 - 3.346, 2.962 -3.910, and 4.068 – 5.250 at 90%, 95%, and 99%, respectively. (Nkoro & Uko, 2016)

relationship). Therefore, a long-run relationship between the Leadership and Innovation variable (TM) and the Erasmus Program variables (SM and BG) exists **(C)**.

From **(A)**, **(B)** And **(C)** we conclude that we have a mixture of DSP time series with integration order less than 2 (I(2)), moreover, it exists only one long-run relationship among the underlying variable. Consequently, the ARDL technique is more appropriate for our study, we shall now be running the modeling process.

3. 4. 1. The optimal ARDL Model using AIC:

Figure (2): AIC for the optimal ARDL model
Akaike Information Criteria (top 20 models)



The source: Made by researchers using EViews 10.

From the 1st plot we denote that the ARDL model (2,2,0) is the optimal choice among the 19 other presented models, it was picked because it has the less value of Akaiki Information Criteria (AIC).

3. 4. 2. Diagnostic tests:

As we chose the optimal model for our study, we should ensure that our estimation does not suffer from non-normality of the error terms, serial correlation nor the heteroskedasticity. The tests results are presented in Table 4.

Table (5): Error terms diagnostic Table title

Test Hypothesis	Test	Value / F-statistic	Prob***
H0: Normal distribution for error terms	Jarque-Bera	1,866	0,393
H0: No serial correlation of the error terms	Breusch-Godfrey	2.485	0,120
H0: No Heteroscedasticity of the error terms	Breusch-Pagan-Godfrey Arch-	1.978	0.142

The source: Made by researchers using EViews 10.

As we observe from Table 4, all the null Hypothesis (H0) are accepted. As a result, our model does not suffer from non-Normality of the residuals, Serial Correlation nor the Heteroscedasticity of the error terms, these results allow us to say that our model is statistically accepted, in other word, our estimation is correct and the ARDL (2,2,0) highly explains the relationship between the student mobility, Erasmus program annual Budget and the higher education entrepreneurship spirit of the graduated students in the European Union.

**3. 4. 3. ARDL Shor-run and Long-run Dynamics:
a. The Short-run Analysis – The Error Correction Model –**

The ARDL model is reparametrized into ECM when there is one cointegrating vector among the variables which is applicable in our case. The reparametrized result gives the short-run dynamics and the long run relationship between the entrepreneurship and the underlying Erasmus program variables taken into consideration in this study.

Table (6): The Short-run dynamic coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob***
ΔTM_{t-1}	0.437082	0.145894	2.995887	0.0103***
ΔSM	-	0.253540	-0.33210	0.7451
ΔSM_{t-1}	0.041444	0.249595	0.166045	0.8707
ecm_{t-1}	-	0.193123	-5.90440	0.0001***

The source: Made by researchers using EViews 10.

The Table 5. Illustrates the short-run dynamics coefficients obtained from the Error Correction model (ECM). The Equilibrium correction term (ecm_{t-1})^{3*} estimated at -1,14 which has the expected sign, (PESARAN, SHIN, & SMITH, 2001), and highly significant. Consequently, the error correction mechanism is validated, (Lounes, 2012) and a long-run relationship between the underlying variables exists. This coefficient (ecm_{t-1}) expresses how quickly the equilibrium is restored once the model is out of equilibrium, it is estimated to be (-1.14) for our ARDL model, which indicates a high speed of readjustment to long-run equilibrium, in other word, 114% of the Trademark last year's maladjustments are corrected during the current year.

In the short-run we observe that the Student Mobility (SM) in the current year has a negative impact on the creation of the Trademarks (TM). Otherwise, the Student Mobility past value (t-1) has a positive impact on the Trademarks creation, but both the SM in the current year and the year before (t-1) are statistically non-significant. These results reflect the study period, where most of the students can not realize any other projects (a trademark), during this period (3-12 months, renewable) the students can have only an idea about a project because it is a period of acquisition of knowledge and entrepreneurial attitude. This explains the non-significant of the explanatory variables in the short run analysis.

After the ECM analysis, we will figure out next if a significant long run relationship between the underlying variables exists.

b. The Long-run Analysis – The Long-run Relationship –

As we have a single long-run relationship the ARDL modeling procedure can distinguish between the regressors and the dependent variable, the long-run relationship is illustrated in Table 6.

Table (7): The long-run dynamic coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob***
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3* This coefficient should be negative and significantly different from 0. (Sekali, 2018). This coefficient is also called the negative speed-of adjustment coefficient ($-\alpha$). It measures how strongly the dependent variable reacts to a deviation from the equilibrium relationship in one period or, in other words, how quickly such an equilibrium distortion is corrected. (Sebastian & Schneider, 2018)

LSM	0.387180	0.124074	3.120551	0.0081***
LBG	0.342563	0.080290	4.266591	0.0009***
C	7.326024	0.252591	29.00355	0.0000***

The source: Made by researchers using EViews 10.

The Table 5, shows the results of the long-run relationship coefficients (Estimated elasticities) between the Trademarks created, the number of student mobility in the European area and the annual Erasmus program budget.

The long-run cointegration relationship equation estimated using our ARDL (2,2,0) model is presenting as the following;

$$TM = 7,3260 + (0,3871*SM + 0,3425*BG)$$

Equa.1

The analysis of the long-run relationship (Equa.1), demonstrated that both Student Mobility and the Erasmus annual Budget have a positive impact on the creation of Trademarks in the European union, in other word, the Erasmus annual Budget devoted to knowledge alliance between higher education institutions and higher education and the Erasmus Students Mobility have a positive influence on the development of the entrepreneurial spirit and innovation of the graduated students in the European Union during the period 1996-2017 measured by the trademarks created (the Erasmus students tend to create their own business after few years of graduation). which by our results an increase in the number of Erasmus student mobility (SM) and the annual Erasmus Budget (BG) by 1% will increase the Trademarks creation (TM) by 0,3871% and by 0,3425% respectively.

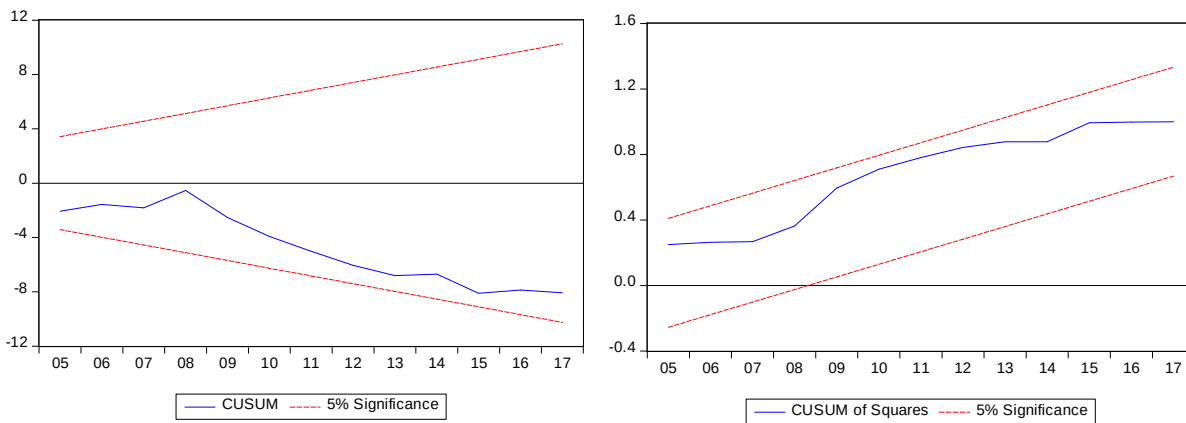
According to these results, we conclude that the aim of the Erasmus program which is supporting business and entrepreneurship spirit is confirmed during the period 1996-2017 and would be achieved in the long term under these variables.

3. 4. 4. The Stability test and the power of Prediction:

a. The Stability Test

In order to verify the stability of the regression parameters of our ARDL model estimated over the long-run, we plot the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares (CUSUMSQ) tests to clarify whether the regression coefficients are generally stable over the sample period and do not show any evidence of statistically significant break.

Figure (3): The stability test (CUSUM and CUSUMQ tests)



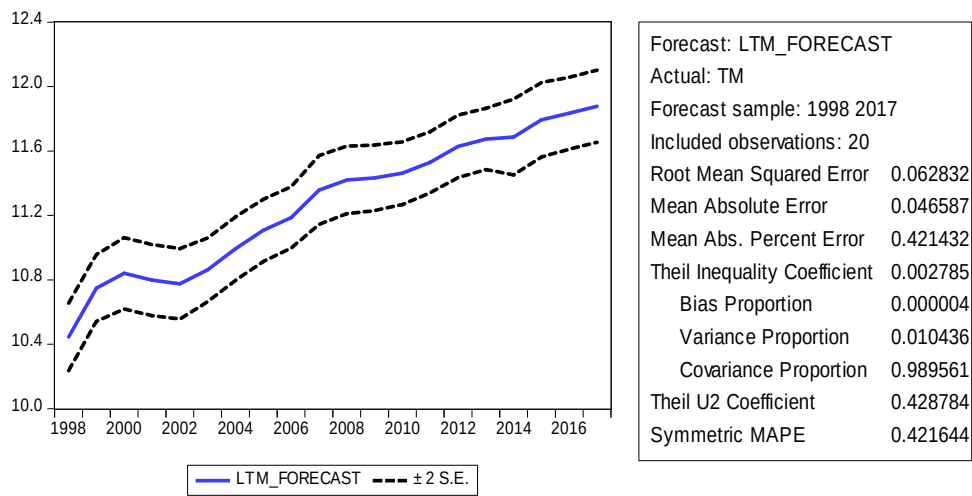
The source: Made by researchers using EViews 10.

The results show that the graph of CUSUM and CUSUMQ doesn't show any breaks out of the intervals, which means that its statistics remains within the range of critical values at the 5% threshold. Finally, we conclude that the regression coefficients are stable over the long-run relationship.

b. The Power of Prediction:

Our dependent variable in the ARDL model is the created Trademarks (TM) included with 2 lags, to perform the power of prediction of our ARDL (2,2,0) model we used the Theil test basing on Theil's inequality coefficient (U). Theil coefficient is scale invariant and it lies between zero and one. If the Theil coefficient equals zero then we have a perfect fit. (Woschnagg & Cipan, 2004)

Figure (4): The stability test (CUSUM and CUSUMQ tests)



The source: Made by researchers using EViews 10.

From the 3rd plot we conclude that the THEIL coefficient (U) is very small and close to zero (0.00278) which indicates that the model has a high predictive ability.

4. Conclusion:

The objective of this research is to highlight the role of Erasmus program in higher education at driving innovation and entrepreneurship in the EU countries during the period 1996 to 2017 and to figure out whether this objective is realized and would be achieved in the future. To do that, we measured the influence of the number of Erasmus Student Mobility and the Erasmus Budget devoted to knowledge alliances between higher education institutions and enterprises which aim to foster innovation, entrepreneurship, creativity, employability, knowledge exchange and/or multidisciplinary teaching and learning on the Trademarks created in the EU which were used in our study to measure the entrepreneurship and innovation. Finally, we have come up with a set of results that can be summarized as the following:

- The objective of the Erasmus program to drive innovation and entrepreneurship through higher education was achieved during the period of the study and would be accomplished in the future under these considerations.
- Through our analysis we find out that there is a positive implications of the Erasmus Student Mobility and the Erasmus Budget on the creation of Trademarks (Entrepreneurship and innovation in higher education) in the EU, where an increase of 1% in the number of Erasmus Student Mobility (SM) and the annual Erasmus Budget (BG) leads to an increase in the Trademarks creation (TM) by 0,3871% and by 0,3425% respectively.

Finally, our research in this kind of program gave us inspiration to propose similar program specified to the Arabic countries which is establishing a special exchange program in the Arab countries region that supports the student's mobility in the framework of bilateral agreements

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between institutes of higher education and cooperation programs between scientific research laboratories to develop scientific research and innovation among its students.

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